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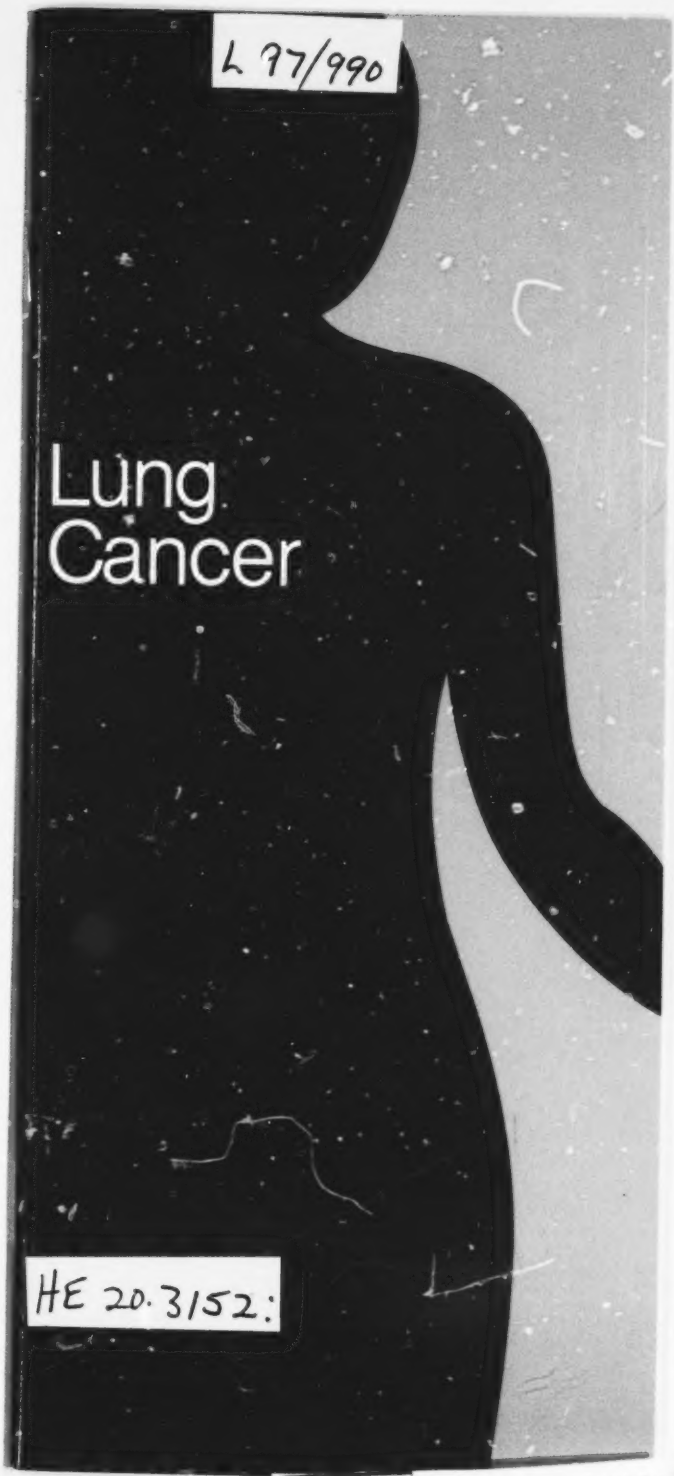

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The National Cancer Institute (NCI) has prepared this booklet to help patients and their families better understand and cope with cancer of the lung. We also hope that it will encourage all readers to learn more about this disease. The information presented here—on the symptoms, diagnosis, and treatment of lung cancer and the outlook for lung cancer patients—is intended to add to information supplied by doctors, nurses, and other members of the medical team.

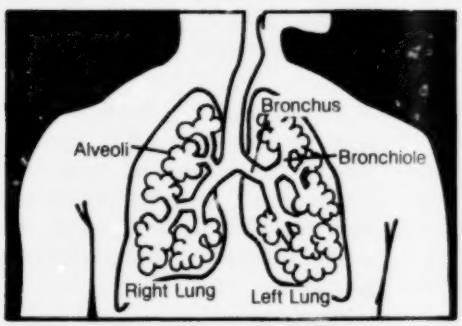
Our knowledge about lung cancer and other types of cancer is increasing rapidly. Research sponsored by the NCI and by other groups has led to better methods of diagnosing and treating cancer, and it offers hope that in the future more patients with lung cancer will be treated successfully.

Throughout this booklet, words that may be new to readers are printed in italics. Definitions of these and other terms related to lung cancer are found near the end of the booklet. For some words, a simple, "sounds-like" spelling is also given.

Other NCI publications about cancer, its treatment, and living with the disease are listed at the back of this booklet along with the toll-free telephone numbers for the NCI-supported Cancer Information Service (CIS). The CIS can provide information about cancer and cancer-related resources to patients, their families, and the general public.

The Lungs

The lungs, a major part of the respiratory system, are a pair of cone-shaped organs made up of pinkish-gray, spongy tissue. They occupy most of the chest cavity and are separated from each other by the *mediastinum,* which is an area in the chest containing the heart, trachea (windpipe), esophagus, and *lymph nodes.* The right lung has three sections, called *lobes,* and is a little larger than the left lung, which has only two lobes. The lungs exchange gases between the body and the air. They remove carbon dioxide, a waste product of the body's cells, and take in oxygen, which is necessary for cells to live and carry out normal activities.



Air enters the body through the nose and mouth and travels down the throat, through the larynx (voice box), and into the lungs through tubes called *bronchi.* One bronchus goes to the right lung and one to the left lung. The bronchi divide into smaller and smaller tubes called *bronchioles,* which end in tiny air sacs called *alveoli.*

Cancer is a group of diseases. There are more than 100 different types of cancer, but they all have one thing in common—the abnormal growth of cells that destroy body tissue rather than build and repair it.

Healthy cells that make up the body's tissues grow, divide, and replace themselves in an orderly manner. This process keeps the body in good repair. Sometimes, however, normal cells lose the ability to limit and direct their growth. They divide and grow without any order and form tumors. Tumors can be one of two types:

- Tumors that are not cancers are called *benign.* They do not spread to other parts of the body and are seldom a threat to life. Often, benign tumors can be removed by surgery, and they are not likely to return.
- Cancerous tumors are called *malignant.* They invade and destroy nearby healthy tissues and organs. Cancers can also *metastasize,* or spread, to other parts of the body causing new tumors.

Because cancer can grow and spread, it is important for the doctor to find out as early as possible if a tumor is present and whether it is benign or malignant. As soon as a diagnosis of cancer is made, the doctor can begin treatment to control the disease.

Types of Lung Cancer

Lung cancers are generally divided into two types: *small cell lung cancer* and *nonsmall cell lung cancer.* The tumor cells of each type grow and spread differently, and they are treated differently.

Small cell lung cancer is sometimes called *oat cell cancer* because the cancer cells look like oats when they are viewed under a microscope. This type of lung cancer makes up about 20 to 25 percent of all cases. It is a rapidly growing cancer that spreads very early to other organs. It is generally found in people who are heavy smokers.

There are three main kinds of nonsmall cell lung cancer, and they are named for the type of cells found in the cancer.

- *Epidermoid carcinoma,* which is also called *squamous cell carcinoma,* makes up about 33 percent of all lung cancer cases. (*Carcinoma* is a cancer that begins in the lining or covering tissues of an organ.) This type of lung cancer often begins in the bronchi and may remain in the chest without spreading for longer periods than the other types. It is the most common type of lung cancer.
- *Adenocarcinoma* accounts for about 25 percent of all lung cancers. It often grows along the outer edges of the lungs and under the tissue lining the bronchi.
- *Large cell carcinomas* make up about 16 percent of all lung cancer cases. These cancers are found most often in the smaller bronchi.

More information about the types of lung cancers can be found in the NCI publication *Research Report: Lung Cancer.*

Symptoms

Lung cancer may cause a number of symptoms. A cough is one of the more common symptoms and is likely to occur when a tumor grows and blocks an air passage. Another symptom is chest pain, which feels like a constant ache that may or may not be related to coughing. Other symptoms may include shortness of breath, repeated pneumonia or bronchitis, coughing up blood, hoarseness, or swelling of the neck and face.

In addition, there may be symptoms that do not seem to be at all related to the lungs. These may be caused by the spread of lung cancer to other parts of the body. Depending on which organs are affected, symptoms can include headache, weakness, pain, bone fractures, bleeding, or blood clots.

Sometimes symptoms may be caused by hormones that are produced by lung cancer cells. For example, certain lung cancer cells produce a hormone that causes a sharp drop in the level of salt (sodium) in the body. A decrease in sodium level can produce many symptoms, including confusion and sometimes even coma. Like all cancers, lung cancer can also cause fatigue, loss of appetite, and loss of weight.

These symptoms may be caused by a number of problems. They are not a sure sign of cancer. However, it is important to see a doctor if any of these symptoms lasts as long as 2 weeks. Any illness should be diagnosed and treated as early as possible, and this is especially true for cancers.

Diagnosing Lung Cancer

If lung cancer is suspected, a patient undergoes a series of tests to confirm whether cancer is present. Once cancer is diagnosed, doctors do more tests to learn if the disease has spread. This process is called staging.

When symptoms suggest that there might be cancer growing in the lungs, the first step for all patients is a complete physical examination. This includes telling about any health problems, work history, and anything else that might be important in learning the cause of the symptoms. The physical examination is usually followed by chest x-rays. Next, the doctor may want to collect cells from the lungs so that they can be examined under a microscope. This is important because it is the only sure way to know if cancer is present and, if it is, to identify the type of lung cancer. Doctors may collect cells by *biopsy* using a needle, surgery, or other methods.

In addition to chest x-rays, the patient may have other x-ray tests. For example, a lung tomogram is a series of x-rays of sections of the lung. In computed tomography (*CT* or *CAT scans*), a computer helps produce the pictures. The CT scan is useful in finding out if the tumor has spread from the lung to other parts of the chest or to more distant organs such as the brain or liver.

A test called *bronchoscopy* permits the doctor to see the breathing passages through a thin, hollow, lighted tube. The tube is inserted through the patient's nose or mouth into the lung. The doctor can collect cells from the bronchial walls or snip small pieces of tissue for study under the microscope. This test generally is done in a hospital. The patient, who is given a local anesthetic and is awake during the test, usually can go home a few hours later.

A new procedure, used to collect cells that are hard to reach with the bronchoscope, is called needle aspiration biopsy guided by *fluoroscopy*. Fluoroscopy is an x-ray test that uses a television screen so that internal organs, such as the heart, can be viewed while they are in motion. Using the picture on the screen as a guide, the doctor inserts a needle into the tumor to withdraw cells for examination.

The doctor may use a test called *mediastinoscopy* to learn if cancer cells have spread to lymph nodes in the mediastinum. This test requires an incision in the chest, so the patient is given a general anesthetic. *Mediastinotomy* is similar to mediastinoscopy, except the incision is made in another part of the chest.

Doctors also may perform *scans* to locate lung cancer cells that may have spread to the brain, bone, or liver. In these tests, a substance that is mildly radioactive is injected into the blood, and a machine then scans the body to measure radiation and detect abnormal areas.

Treatment for lung cancer depends on the type of cancer cells, the location of the tumor, and the stage of the cancer (whether it is just in the lungs or it has spread to other organs). After diagnosis and staging, the doctor develops a treatment plan to fit the type and location of the cancer as well as the patient's medical history and general health.

Treatment Planning

Before starting treatment, the patient might want a second doctor to review the diagnosis and treatment plan. If so, there are a number of ways to get a second opinion:

- The doctor can discuss a patient's case with other physicians who treat lung cancer. Names of these doctors are available from PDQ (Physician Data Query). This NCI computerized system also contains up-to-date treatment information for more than 80 different types of cancer. (Information about PDQ is found at the end of this booklet.)
- Patients can get the names of doctors to consult about their treatment plan from the local medical society, nearby medical schools, or the *Directory of Medical Specialists,* a book available in many libraries.
- The Cancer Information Service, whose telephone number is listed at the back of this booklet, also may be able to help patients locate doctors to consult for a second opinion.

Treating Lung Cancer

There are three basic ways to treat lung cancer: surgery, *radiation therapy,* and *chemotherapy.* The type of surgery that the doctor recommends depends on the size and location of the tumor. Radiation therapy (also called x-ray therapy, radiotherapy, or irradiation) uses high-energy rays to kill cancer cells. The use of anticancer drugs to treat cancer is called chemotherapy. Sometimes, a combination of these methods is used.

Treating Small Cell Lung Cancer

Small cell lung cancer spreads quickly to distant parts of the body. Often these second tumors cannot be found by routine tests. Thus, treatment with surgery or radiation therapy to the chest usually is not effective in controlling small cell lung cancer.

Patients with small cell lung cancer are commonly treated with a combination of several anticancer drugs or with anticancer drugs plus radiation to the chest. The radiation is directed to the original (primary) tumor in the lungs, while chemotherapy is used to reach tumors in other parts of the body.

Treating Nonsmall Cell Lung Cancer

Patients with nonsmall cell lung cancer generally can be divided into three groups. The first group includes patients whose cancer is only in the lung and whose tumor can be removed by surgery. An operation that removes only a small part of the lung is called a wedge resection. When an entire lobe of the lung is removed, the procedure is called a *lobectomy. Pneumonectomy* is the removal of the entire lung. Radiation therapy may be used to treat patients in this group who cannot have surgery because of other medical problems.

The second group is nonsmall cell lung cancer patients whose cancer has spread to nearby tissue or lymph nodes. The usual treatment for these patients is radiation therapy to the chest. This treatment is sometimes combined with other forms of treatment, especially surgery.

The third group includes patients whose cancer has spread to distant parts of the body. Radiation therapy and chemotherapy are used to shrink the cancer and to relieve symptoms.

Side Effects of Treatment

Because cancer can spread rapidly and threaten life, the treatments used against this disease must be very powerful. It is rarely possible to limit the effects of cancer treatment so that only cancer cells are destroyed; normal, healthy cells may be damaged at the same time. For this reason, many patients experience unpleasant side effects while they are having cancer treatments. Doctors try to plan treatments to keep such side effects to a minimum. Most side effects end soon after treatment.

Certain problems can occur following surgery to remove cancer in the lungs. For example, blood loss during an operation on the chest may be greater than blood loss during other types of surgery. Other complications are caused by damage to or removal of lung tissue. In such cases, patients may have difficulty breathing and sometimes can become drowsy.

Radiation at high levels destroys the ability of cells to grow and divide. Both normal cells and cancer cells are affected, but most normal cells are able to recover quickly. Radiation therapy is usually given 5 days a week for several weeks. This schedule helps to protect healthy tissues by

spreading out the total dose of radiation and by giving rest breaks so that normal cells can recover. During radiation therapy, the side effects that patients notice most often are unusual tiredness, painful swallowing, and skin reactions in the area being treated.

Drugs used to treat cancer are given to patients in different ways: some are given by mouth; others are injected into a muscle, a vein, or an artery. The anticancer drugs travel through the bloodstream to almost every part of the body, helping to stop the growth of cancer cells. Chemotherapy is most often given in cycles—a treatment period, followed by an "off" or "rest" period, then another treatment period, and so on.

Depending on which drugs the doctor orders, the patient may need to stay in the hospital for a few days so that the drugs' effects on the body can be watched. Sometimes, the patient may receive treatments as an outpatient at the hospital, at the doctor's office, or at home.

Chemotherapy affects not only cancer cells but also other rapidly growing cells, such as blood cells, hair cells, and cells that line the digestive tract. As a result, the patient may have side effects such as anemia, an increased risk of infection or bleeding, hair loss, nausea, and vomiting. Fatigue also may occur during treatment with anticancer drugs.

Loss of appetite can be a serious problem for cancer patients. Researchers are learning that patients who eat well are better able to stand the side effects of treatment. Therefore, nutrition is an important part of the treatment plan. Eating well means getting enough calories to prevent weight loss and having enough protein in the diet to build and repair skin, hair, muscles, and organs. Many patients find that eating several small meals during the day is easier than eating three large meals.

Doctors, nurses, dietitians, and other members of the medical team can provide advice about the side effects that might occur during cancer treatment and how best to deal with them. Further information on cancer treatment and side effects is given in the NCI publications ***Radiation Therapy and You, Chemotherapy and You,*** and ***Eating Hints.***

Adjusting to the Disease

In addition to providing information about lung cancer and its treatment, this booklet was written to help people better understand and be more sensitive to the feelings of lung cancer patients and those who care about them. It is very stressful for a person to learn that he or she has cancer, and it is common for many different and sometimes confusing emotions to appear when cancer is found.

Sometimes, cancer patients and family members may be depressed or angry. At other times, their feelings may vary from hope to despair or from courage to fear. These feelings are normal reactions for people dealing with a disturbing change in

their lives. Patients usually are better able to cope with emotional stresses if they can talk openly about their illness and their feelings with family members and friends.

Concerns about treatments, tests, or a hospital stay are common. Talking to doctors, nurses, or others of the health care team can help to ease fear and confusion. Patients can take an active part in decisions about their medical care by asking questions about lung cancer and its treatment. Patients and family members often find it helpful to write down questions as they think of them to ask the doctor. Taking notes during visits to the doctor can help them remember what was talked about. Patients should ask the doctor to repeat or explain more fully anything that is not clear.

Most patients want to know what kind of lung cancer they have, how it can be treated, and how successful the treatment is likely to be. The patient's doctor is the best person to answer these questions. Other questions for the doctor might include:

- What are the benefits of treatment?
- What are the risks and side effects of treatment?
- How often are checkups needed?
- Is it possible to keep working?
- What changes in normal activities will be required?
- How much will the treatment cost?

People being treated for lung cancer may need to change their lifestyle. The ability to work or carry on other activities may be altered—perhaps for a short time, perhaps permanently. The patient's doctor is the best person to give advice about limits on specific activities, but it may be hard for some patients and family members to talk to the doctor about their feelings and other very personal matters. However, sharing these concerns with the doctor often makes it possible for him or her to respond with understanding and useful guidance. In the same way, sharing feelings with family members and friends can open the way for others to show their concern and offer support. In addition, many patients feel better when they can talk with people who are facing problems similar to their own. This kind of help is available through self-help and support groups such as those described in the next section.

For patients and their families who find it hard to talk with others, it may be helpful to seek professional counseling. Also, if emotional problems of the patient or family become severe, it's best to get help from a mental health professional.

Coping with any serious disease can be difficult. Cancer patients and their families can find suggestions about adjusting to their new situation in the NCI booklets *Taking Time, When Cancer Recurs,* and *Advanced Cancer: Living Each Day.* Also, the public library is a good source for books and articles on living with cancer.

Support for Cancer Patients

Adapting to the changes brought about by having lung cancer is easier for both patients and their families when they get good information and support services. Often, the hospital or clinic social service office can suggest agencies that will help with emotional support, financial aid, home care, or transportation. Also, the American Cancer Society (ACS) provides patient services and education. Local offices of the ACS are listed in the telephone book under American Cancer Society, Inc.

Information about other resources and services is available through the Cancer Information Service toll-free telephone numbers, which are listed at the back of this booklet.

What the Future Holds

The outlook for a person with lung cancer depends on the type of cancer, the stage of the disease, and the patient's age, general health, and response to treatment. Researchers are working to find better ways to diagnose and treat lung cancer, and the chances of controlling the disease are improving every day.

Doctors usually talk about "surviving" cancer, or they may use the words "remission" and "disease-free interval" rather than "cure." These terms are used because cancer may show up again at a later time. Patients often try to figure out their own chances of survival from statistics they have heard or read about. It is important to remember that statistics describe an average of many, many people, and no two cancer patients are alike. Only the doctor who cares for a patient knows enough about that person to discuss the course of the disease.

The Promise of Cancer Research

With financial support from the National Cancer Institute, scientists at hundreds of hospitals and medical centers around the country are studying cancer. Other public agencies and private groups are also conducting cancer research. Among the areas that are under study are the cause, prevention, diagnosis, and treatment of lung cancer.

Cause and Prevention of Lung Cancer

Cigarette smoking causes about 85 percent of lung cancer deaths. If the number of smokers could be substantially reduced, thousands of lives could be saved before the end of this century. The NCI's goal is to reduce the percentage of adults and youths who smoke to 15 percent by the year 2000.

About 10 to 20 percent of all cases of lung cancer occur in people who do not smoke. Work-related hazards, air pollution, and other environmental factors may be involved. Workers who are exposed to

cancer-causing substances, such as asbestos, face an even greater chance of developing lung cancer if they smoke cigarettes.

In addition to many studies on the health hazards caused by the use of tobacco, the NCI is supporting research in the area of chemoprevention of lung cancer. Chemoprevention is the use of natural and manmade substances to prevent cancer. One goal of this research is to find ways to stop or reverse the development of cancer in people already exposed to known cancer-causing substances, such as those found in cigarette smoke.

Diagnosis

A new technique known as magnetic resonance imaging (MRI) produces images of the organs inside the body without exposing the person to radiation. Scientists are studying MRI to learn if it may prove useful in diagnosing and staging lung cancer.

Treatment

The NCI is supporting studies of new treatments for lung cancer, including drug combinations and *immunotherapy*, which uses the body's natural defense system to fight disease. Scientists will study these methods closely to learn whether they can be of value in future treatment.

When research on animals shows that a new treatment method has promise for use against cancer in people, the method is then studied in a clinical trial. A clinical trial is conducted with cancer patients and is designed to answer scientific questions and to find out if a promising new treatment is safe and effective. More information about clinical trials is found in the NCI booklet *What Are Clinical Trials All About?*

The NCI has developed the PDQ database to help doctors across the country learn about these trials. A doctor may obtain information from PDQ by using an office computer or the services of a medical library. Most Cancer Information Service offices provide a physician with one free PDQ search and can tell doctors how to obtain regular access to the database. More information about current research is available through the Cancer Information Service.

Adenocarcinoma (AD-eh-no-kar-si-NO-mah): A cancer that develops in the lining or inner surface of an organ.

Alveoli (al-VEE-o-li): Tiny air sacs at the end of the bronchioles.

Benign tumor (bee-NINE): A growth that is not a cancer and does not spread to other parts of the body.

Biopsy (BY-op-see): Removal of a sample of tissue to see if cancer cells are present.

Bronchi (BRON-ki): The large air tubes leading to the lungs.

Bronchioles (BRON-kee-ols): The tiny branches of air tubes in the lungs.

Bronchoscopy (bron-KOS-ko-pee): A test that permits the doctor to see the breathing passages through a hollow, lighted tube.

Cancer: A general term for more than 100 diseases that are characterized by uncontrolled, abnormal growth of cells. Cancer cells can spread through the blood and lymph (the clear fluid that bathes body cells) to start new cancers in other parts of the body.

Carcinoma (kar-sin-O-mah): Cancer that begins in the lining or covering tissues of an organ.

CAT or CT scan: An x-ray procedure that uses a computer to produce a detailed picture of a section of the body.

Chemotherapy (kee-mo-THER-a-pee): Treatment with anticancer drugs.

Epidermoid carcinoma (ep-i-DER-moid): The most common type of lung cancer; also called squamous cell carcinoma.

Fiberoptic bronchoscope: A thin, flexible instrument used to view the air passages of the lung.

Fluoroscopy (floor-OS-ko-pee): An x-ray test that makes it possible to see internal organs in motion.

Immunotherapy (IM-myoo-no-THER-uh-pee): Treatment that uses the body's immune defense system to fight cancer.

Large cell carcinoma: A type of lung cancer in which the cells are large and do not resemble the cells of other types of lung cancer.

Lobe: A portion of the lung.

Lobectomy (lo-BEK-to-mee): An operation that removes an entire lobe of the lung.

Lymph nodes (limf): Bean-shaped structures located throughout the body. Nodes act as filters, collecting bacteria or cancer cells that may travel through the lymphatic system.

Lymphatic system (lim-FAT-ik): The lymphoid organs (such as the lymph nodes, spleen, and thymus) that produce and store infection-fighting cells and the network of channels carrying lymph (the almost colorless fluid that bathes body cells).

Malignant (ma-LIG-nant): Cancerous (see *Cancer*).

Mediastinoscopy (mee-dee-ah-steh-NOS-ko-pee) and *Mediastinotomy* (mee-dee-ah-steh-NOT-o-mee): Procedures that permit the doctor to view the organs in the mediastinum.

Mediastinum (mee-dee-ah-STY-num): The area that separates the lungs from each other. It contains the heart and its large veins and arteries, the trachea (windpipe), the esophagus, the thymus gland, and lymph nodes.

Metastasis (meh-TAS-ta-sis): The spread of cancer from one part of the body to another. Cells in the new cancer are like those in the original tumor.

Mucous membrane: The tissue lining the inside of the lungs and several other organs.

Mucus: A thick fluid produced by the inner lining of some organs of the body.

Nonsmall cell carcinoma: Epidermoid carcinoma, adenocarcinoma, and large cell carcinoma are grouped under this general classification.

Oat cell cancer: Lung cancer whose cells look like oats when they are viewed under the microscope; also called small cell lung cancer.

Oncologist (on-KOL-o-jist): A doctor who is a specialist in treating cancers.

Paraneoplastic syndrome (pa-ra-nee-o-PLAS-tic): A group of symptoms caused by hormones produced by some lung cancer cells.

Pneumonectomy (nu-mo-NEK-to-mee): An operation that removes the right or left lung.

Radiation therapy: Treatment with high-energy radiation from x-rays or other sources of radiation.

Scan: A test using a radioactive substance to locate tumors.

Small cell carcinoma: A type of lung cancer in which the cells are small and round; also called oat cell carcinoma.

Sputum: Mucus from the bronchial tubes.

Squamous cell carcinoma (SKWA-mus): The most common type of lung cancer; also called epidermoid carcinoma.

Thoracotomy (thor-ah-KOT-o-mee): An operation in which an incision is made into the chest and the lung to look for cancer or other diseases.

Trachea (TRA-kee-ah): Windpipe.

General information about cancer is widely available. Some of the resources and publications listed below may be helpful to patients and their families.

Cancer Information Service
The Cancer Information Service of the National Cancer Institute is a telephone service that responds to inquiries from cancer patients and their families, health care professionals, and the public. Information specialists in CIS offices are available to provide answers to questions about cancer. The toll-free telephone number of the CIS is 1-800-4-CANCER. Spanish-speaking CIS staff members are also available.

American Cancer Society
1599 Clifton Road, NE
Atlanta, GA 30329
(404) 320-3333

The American Cancer Society (ACS) is a voluntary organization offering a variety of patient services. The ACS also is involved in cancer education and research. Local units are listed in the telephone directory.

American Lung Association
1740 Broadway
New York, NY 10019
(212) 315-8700

The American Lung Association is a voluntary organization interested in the prevention and control of lung disease.

American Red Cross
421 18th Street, NW
Washington, DC 20006
(202) 737-8300

The American Red Cross is a network of local chapters that provides various community services including nursing health programs.

For Further Information

The following printed materials may be helpful to cancer patients, their families, and others. They are available free of charge from:

Office of Cancer Communications
National Cancer Institute
Building 31, Room 10A24
Bethesda, MD 20892

- *Advanced Cancer: Living Each Day*
- *Answers to Your Questions About Metastatic Cancer*
- *Chemotherapy and You: A Guide to Self-Help During Treatment*
- *Eating Hints: Recipes and Tips for Better Nutrition During Cancer Treatment*
- *Radiation Therapy and You: A Guide to Self-Help During Treatment*
- *Research Report: Lung Cancer*
- *Taking Time: Support for People with Cancer and the People Who Care About Them*
- *What Are Clinical Trials All About?*
- *When Cancer Recurs: Meeting the Challenge Again*